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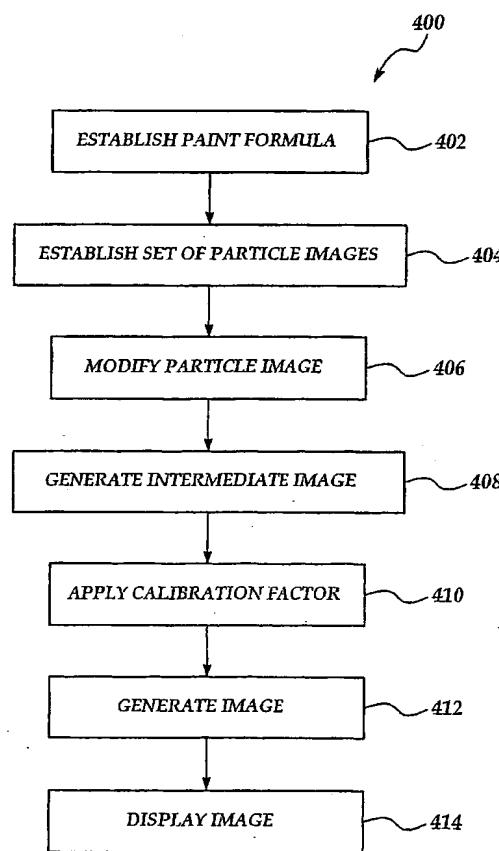
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(54) Title: ELECTRONIC DISPLAY OF AUTOMOTIVE COLORS



(57) **Abstract:** A computer system and method for creating an electronic image displaying effect paint samples is provided. The system includes a first module and an image module coupled thereto. The first module is adapted to establish a paint formula having an effect variable and to establish the effect variable as a function of the paint formula. The image module is adapted to generate an intermediate image having an associated color, to modify the intermediate image as a function of the effect variable, to generate the electronic image, and to display the electronic image.

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- *with international search report*

## ELECTRONIC DISPLAY OF AUTOMOTIVE COLORS

### FIELD OF THE INVENTION

[0001] The present invention relates generally to displaying colors and, more particularly, to a method and system for providing an electronic display of automotive colors.

### BACKGROUND OF THE INVENTION

[0002] Modern vehicles, such as automobiles, are typically offered to consumers in a wide variety of paint colors. Flake pigments are frequently used to add sparkle and special effects to the color. In fact, from model year to model year, it is not uncommon for a particular vehicle model to be available in several new paint colors. The actual color of the produced car may vary depending on any number of factors including changes in paint composition or variations in the paint application process. Actual paint color may vary depending on any number of factors, such as effect pigments and variations in the paint application process. Consequently, when a vehicle's body panels are damaged and require repairs (including repainting), the paint manufacturer supplies one or more paint formulations for the original paint color to customers, such as repair shops.

[0003] By supplying a plurality of formulations of variances for a particular color, the paint manufacturer accounts for those factors which affect the actual color. Typically, the formulations for a particular color are distributed to repair shops, i.e., "bump" or collision shops, on paper, microfiche, and/or compact disks (CD). A

color tool, composed of swatches of the variances for each color may also be produced and delivered to each customer.

[0004] Furthermore, the customer must select which formulation most closely matches that part to be painted. This is typically done visually, i.e., by comparing 5 swatches to the part or spraying a test piece with each formulation.

[0005] Different formulations are derived from actual data gathered by inspectors at various locations, e.g., the automobile manufacturer or vehicle distribution point. The inspectors take color measurement readings from new automobiles which have a particular paint color and one or more effect pigments. These readings are used to 10 develop color solutions, i.e., different paint formulations for the same color.

[0006] In addition, it is common practice to examine color samples under a microscope as an aid to color matching. Analysis of a microscopic image provides information about the type and quantity of effect pigments contained in the coating. The ability to construct a mock microscopic image from a given color formulation 15 would be a valuable aid to color matching processes. Such constructed images could, for example, be compared to the standard image to help in selecting the best starting point for a color match formulation.

[0007] There are several disadvantages to the present method of distributing color solutions in this manner. One disadvantage is the cost. A copy of the paper or CD 20 listing of all of the solutions for each color must be printed and sent to each customer, i.e., repair shop. Furthermore, new formulations are periodically developed. The new formulations and any other corrections must be sent to each customer. It is a time consuming and a laborious process to make sure every customer has the most up to date formulations. In addition, customer satisfaction is

significantly reduced when the color and the effect pigments for a particular formula are not accurately represented in either an electronic image or on a swatch, thereby preventing the customer from making an informed decision.

[0008] Further, many automobiles have auxiliary paint colors. Auxiliary paint colors may be used on various parts of interior or the exterior of the automobile, for example, trim, molding, wheel covers, bumpers, stripes or parts within the passenger compartment. Identifying an auxiliary paint color may be difficult, since auxiliary colors are not typically listed on the vehicle identification plate (located on the vehicle). Additionally, as a result of the many different application areas used on recent automobiles, it is often difficult to unambiguously describe the area of interest.

[0009] Accordingly, the present invention is aimed at solving one or more of the problems identified above.

15

## SUMMARY OF THE INVENTION

[0010] In one aspect of the present invention, a computer system for creating an electronic image displaying effect paint samples is provided. The system establishes a paint formula having an effect variable and generates an intermediate image having an associated color. The system further modifies the intermediate image as a function of the effect variable, generates the electronic image as a function of the paint formula, and displays the electronic image.

[0011] In another aspect of the present invention, a computer based method for creating an electronic image displaying effect paint samples is provided. The method includes the steps of establishing a paint formula having an effect variable,

determining an associated color, establishing the effect variable, generating an intermediate image having the associated color, modifying the intermediate image as a function of the effect variable, generating the electronic image as a function of the paint formula, and displaying the electronic image.

5

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Other advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings 10 wherein:

[0013] Figure 1 is a block diagram of a computer system for providing an electronic image displaying effect paint samples, according to an embodiment of the present invention;

[0014] Figure 2 is a block diagram of a computer system for providing an 15 electronic image displaying effect paint samples, according to an embodiment of the present invention;

[0015] Figure 3 is a flow diagram of a method for providing an electronic image displaying effect paint samples, according to an embodiment of the present invention; and

20 [0016] Figure 4 is a flow diagram of a method for providing a constructed microscopic image of an effect paint sample according to an embodiment of the present invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0017] Referring to the Figures, wherein like numerals indicate like or corresponding parts throughout the several views, a computer based system 100 for creating an electronic image displaying effect paint samples is provided. Generally, 5 the method includes the steps of establishing a paint formula having an effect variable, and generating the electronic image as a function of the paint formula.

[0018] With particular reference to the embodiment illustrated in Figure 1, the system 100 includes a database 102 and a processing unit 104. The database 102 may include paint formulas and other information. In one embodiment of the 10 present invention, the processing unit 104 is embodied in a computer 106 and a computer program application 108 running on the computer. The user 110 interacts with the computer program application 108 through a graphical user interface or "GUI" 112. Furthermore in another embodiment, the system 100 may include a plurality of computers 106 which are connected into a network (not shown). 15 Specified computers or users on the network have access to the system and methods of the present invention.

[0019] In one embodiment, the system 100 may include a printer 114 which allows color swatches and other data to be printed on paper. Alternatively, the printer 114 may be separate from the system 100 or connected to another computer on the 20 network.

[0020] With reference to Figure 2, the system 100 includes a first module 202 and an image module 204 coupled thereto. In one embodiment, the first module 202 and the image module 204 are implemented in the computer program application 108 running on the computer 106.

[0021] In another embodiment, the first module 202 is implemented on a first computer (not shown), such as a personal computer or a wireless computing device. The first module 202 is adapted to be operated by a user or operator through a customer interface 206 located at a remote location. The interface 206 allows the 5 operator to log on to the system 100 and request and receive information, such as paint formulas. The customer interface 206 is graphical in nature, and is accessed through a generic world wide web (WWW) browser, such as Microsoft™ Internet Explorer, available from Microsoft of Redmond, Washington. The image module 204 is implemented on a second computer (not shown). Generally, the image 10 module 204 is adapted to generate the electronic image as a function of the paint formula. The first module 202 is coupled to the image module 204 across a computer network 208 such as the Internet.

[0022] The first module 202 is adapted for establishing a paint formula having an effect variable, wherein establishing the paint formula includes inputting the 15 formula by a user or from another source, receiving the formula from a data file or database, or any other suitable means for establishing the paint formula. The effect variable may include a variable representing a flake-like material added to paints to produce a sparkle and color values which change with viewing angle. Variables commonly consist of a variable representing an aluminum or mica based flake. The 20 flakes may be coated with a pigment layer and may even include multiple layers of differing optical and color properties. The paint formula represents the color and effect variables by quantity, such as weight. The effect variable in the paint formula represents the sparkle and texture.

[0023] The paint formulas stored in the database 102 can be created by measuring color automotive color standards or color swatches with a spectrophotometer. The database 102 is embodied in software. The color values are then transformed to R (red), G (green), B (blue) values. The color values are implemented in software and stored in the database 102. As such, the color values may be retrieved from the database 102. The color values may be derived from the paint formula using a neural network, linear transformation, or any other suitable routine for deriving color values from the paint formula. However, the spectrophotometer does not record the sparkle and texture created by effect variables. Instead, the sparkle and texture must be established as a function of effect variables in the paint formula.

10 [0024] In addition, to construct an electronic image having a microscopic image of a paint formula as a function of a plurality of sets of particle images, each set of particle images represents an effect variable and is stored in the database 102. These sets are used to construct a microscopic image of the paint formula.

15 [0025] The effect variable may represent a metallic flake, a pearl flake, a sparkle effect, an intensity effect, viewing angle, or any other suitable effect variable. The effect variable includes at least one associated attribute, such as quantity and concentration, having an associated property, such as size, color, and transparency. For example, the associated attribute may include the quantity, e.g., weight, of the 20 particular associated property. The effect variable represented in the paint formula indicates a flake pigment of a particular size, a particular color or a particular transparency in a particular concentration.

[0026] The first module 202 is adapted to establish the effect variable as a function of the paint formula. The first module 202 is also adapted to establish the

associated attribute and the associated property. The associated property may be established as a function of the associated attribute.

[0027] The image module 204 is adapted to generate an intermediate image having an associated color. The image module 204 is further adapted to generate an 5 intermediate image as a function of at least one set of particle images.

[0028] The associated color is the primary or background automotive color represented in the image. The associated color may be determined as a function of the paint formula, as a function of color values, or by any other suitable means. The image module 204 is further adapted for modifying the intermediate image as a 10 function of the effect variable and/or the particle image.

[0029] Due to manufacturing differences in image modules 204, the RGB values may be displayed as a different hue than the true associated color. For example, the associated color may be red, yet displayed by the image module 204 as orange. Thus, the image module 204 is adapted to apply a calibration factor to the color 15 values to ensure that the associated color displayed matches the actual associated color represented by the color values. The image module 204 is further adapted to apply a calibration factor to the particle image to ensure that the particle image displayed represents the true effect variable. The image module 204 is also adapted to correlate the effect variable established as a function of the paint formula with 20 the particle image in the microscopic image.

[0030] In addition, the image module 204 is adapted to generate the electronic image as a function of the paint formula and for displaying the electronic image. The displayed electronic image may include a plurality of pixels, wherein each pixel or cluster of pixels represents an associated color or an effect variable particle.

[0031] With reference to Figure 3, a computer-based method 300 for creating an electronic image displaying effect paint samples will now be explained. Preferably, the method is embodied in software. In a first control block 302, a paint formula having an effect variable is established. As discussed above, the effect variable 5 may include at least one associated attribute having an associated property. The paint formula may be retrieved from a database, input from the customer, or established by any other manner that is suitable for establishing a paint formula. In a second control block 304, the associated color is determined. The associated color may be retrieved from a database, obtained via a neural network system, or 10 established by any other manner that is suitable manner. In a third control block 306, the effect variable is established having the associated attribute and the associated property. In a fourth control block 308, a value of the associated attribute is established. In a fifth control block 310, an intermediate image is generated as a function of the associated color. In a sixth control block 312, the 15 intermediate image is modified as a function of the effect variable. In an seventh control block 318, a calibration factor is applied to the RGB values of the associated color such that the associated color displayed represents the true associated color. In an eighth control block 316, the electronic image is generated as a function of the paint formula. In a ninth control block 318, the electronic 20 image is displayed. Because the effect variables may produce an image whose properties vary with viewing angle, this method may be used to generate images of the paint sample as though viewed at a variety of viewing angles.

[0032] Referring to Figure 4, a computer-based method 400 for constructing an electronic image having a microscopic image of a paint sample will now be

explained. Preferably, the method 400 is embodied in software. In a first control block 402, a paint formula having an effect variable is established. The paint formula may be retrieved from a database, input from the customer, or established by any other manner that is suitable for establishing a paint formula. In a second 5 control block 404, a set of particle images for each effect pigment is established as a function of the paint formula. The set of particle images may be retrieved from a database, input from the customer, or established by any other suitable manner of establishing a particle image. In a third control block 406, the particle image is modified. In a fourth control block 408, an intermediate microscopic image is 10 generated as a function of the modified particle image. In an fifth control block 410, a second calibration factor is applied to the particle image of the effect variable such that the particle image displayed represents the true effect variable. In a sixth control block 412, the microscopic image is generated as a function of the paint formula. In a seventh control block 414, the microscopic image is displayed.

15 [0033] The foregoing detailed description demonstrates that the preferred embodiments of the present invention are well suited to fulfill the objectives of the invention. It is recognized that those skilled in the art may make various modifications or additions to the preferred embodiments chosen herein to illustrate the present invention, without departing from the spirit of the present invention.

20 Accordingly, it is to be understood that the subject matter sought to be afforded protection should be deemed to extend to the subject matter defined in the appended claims, including all equivalents thereof.

## CLAIMS

What is claimed is:

1. A computer based method for creating an electronic image displaying effect paint samples, said method comprising the steps of:
  - 5 establishing a paint formula having an effect variable; and
  - generating the electronic image as a function of the paint formula.
2. A computer based method, as set forth in claim 1, wherein the step of generating the electronic image includes the step of generating an intermediate image having an associated color.
- 10 3. A computer based method, as set forth in claim 2, including the step of determining the associated color as a function of paint formula and/or color values.
4. A computer based method, as set forth in claim 3, including the step of determining the associated color as a function of color values and further 15 comprising the step of determining the color values as a function of the paint formula.
5. A computer based method, as set forth in claim 4, including the step of retrieving color values from a database.
6. A computer based method, as set forth in claim 2, wherein the 20 step of generating the electronic image includes the step of modifying the intermediate image as a function of the effect variable.

7. A computer based method, as set forth in claim 2, wherein the effect variable includes an associated attribute having an associated property.

8. A computer based method, as set forth in claim 7, including the step of establishing the associated attribute.

5 9. A computer based method, as set forth in claim 8, including the step of establishing the associated property.

10. A computer based method, as set forth in claim 8, including the step of establishing the associated property as a function of the associated attribute.

10 11. A computer based method, as set forth in claim 8, including the step of modifying the intermediate image as a function of the associated attribute and/or a function of the associated property.

12. A computer based method, as set forth in claim 8, including the step(s) of displaying the electronic image and/or applying a calibration factor to the color values.

15 13. A computer based method, as set forth in claim 1, wherein the effect variable includes variables selected from the group consisting of sparkle effect, intensity effect, viewing angle and combinations thereof.

14. A computer based method, as set forth in claim 8, wherein the associated attribute is quantity.

20 15. A computer based method, as set forth in claim 8, wherein the associated property includes at least one of size, color, and transparency.

16. A computer based method, as set forth in claim 14, wherein the electronic image includes a plurality of pixels and/or a microscopic image of paint samples.

17. A computer based method, as set forth in claim 16, including the 5 step of establishing the effect variable as a function of the paint formula wherein the effect variable includes a set of particle images.

18. A computer based method for creating an electronic image displaying effect paint samples, said method comprising the steps of:  
establishing a paint formula having an effect variable, the effect 10 variable including an associated attribute having an associated property;  
determining an associated color as a function of the paint formula and/or color values;  
establishing a value of the associated attribute;  
generating an intermediate image as a function of the associated 15 color;  
modifying the intermediate image as a function of the effect variable to generate the electronic image;  
displaying the electronic image, wherein the displayed electronic image optionally includes a plurality of pixels.

20 19. A computer based method for creating an electronic image displaying effect paint samples, said method comprising the steps of:  
establishing a paint formula having an effect variable wherein said effect variable represents a sparkle effect, the effect variable includes

20. A computer based method for creating an electronic image  
displaying effect paint samples, said method comprising the steps of:  
15  
establishing a paint formula having an effect variable;  
establishing a set of particle images associated with each effect  
variable as a function of the paint formula;  
modifying the particle image as a function of the paint formula;  
generating an intermediate image as a function of the modified  
particle image;  
20  
generating an electronic image as a function of the paint formula  
wherein the electronic image includes a microscopic image; and  
displaying the electronic image.

21. A computer system for creating an electronic image displaying effect paint samples, said system comprising:

a first module being for establishing a paint formula having an effect variable; and an image module, coupled to the first module, for generating the electronic image as a function of the paint formula.

5 22. A computer system, as set forth in claim 21, wherein the image module is adapted for generating an intermediate image having an associated color.

23. A computer system, as set forth in claim 21, wherein the first module is adapted for at least one of determining the associated color as a function of the paint formula and/ or the color values.

10 24. A computer system, as set forth in claim 23, wherein the first module is adapted for determining the associated color as a function of color values and for determining color values as a function of the paint formula.

25. A computer system, as set forth in claim 23, wherein the first module is adapted for retrieving the color values from a database.

15 26. A computer system, as set forth in claim 22, wherein the image module is adapted for modifying the intermediate image as a function of the effect variable.

27. A computer system, as set forth in claim 22, wherein the first module is adapted for establishing the effect variable as a function of the paint formula wherein the effect variable includes an associated attribute having an associated property.

28. A computer system, as set forth in claim 27, wherein the first module is adapted for establishing the associated attribute and establishing the associated property.

29. A computer system, as set forth in claim 28, wherein the first 5 module is adapted for establishing the associated property as a function of the associated attribute.

30. A computer system, as set forth in claim 28, wherein the image module is adapted for at least one of modifying the intermediate image as a function of the associated attribute, modifying the intermediate image as a function of the 10 associated property, displaying the electronic image, applying a calibration factor to the color values.

31. A computer system, as set forth in claim 21, wherein the effect variable includes at least one of a sparkle effect, an intensity effect, and a viewing angle.

15 32. A computer system, as set forth in claim 27, wherein the associated attribute is quantity.

33. A computer system, as set forth in claim 27, wherein the associated property is at least one of size, color, and transparency.

20 34. A computer system, as set forth in claim 28, wherein the displayed electronic image includes a plurality of pixels.

35. A computer system for creating an electronic image displaying effect paint samples, said system comprising:

5        a first module for establishing a paint formula having an effect variable, the effect variable including an associated attribute having an associated property, determining an associated color as a function of the paint formula and/or color values, and optionally establishing the effect variable as a function of the paint formula wherein the effect variable includes an associated attribute having an associated property; and

10      an image module, coupled to the first module, for generating an intermediate image as a function of the associated color, and modifying the intermediate image as a function of the effect variable to generate the electronic image, and displaying the electronic image,

wherein when the associated color is determined as a function of color value, the electronic image displayed has a plurality of pixels.

15      36. A computer program product for creating an electronic image displaying effect paint samples, said product comprising:

computer readable program code means for establishing a paint formula having an effect variable; and

20      computer readable program code means for generating the electronic image as a function of the paint formula.

37. A computer program product means for creating an electronic image displaying effect paint samples, said system comprising:

computer readable program code means for establishing a paint formula having an effect variable, the effect variable having an associated attribute

having an associated property, and determining an associated color as a function of the paint formula and/or color values; and

computer readable program code means for generating an intermediate image having the associated color, modifying the intermediate image

- 5 as a function of the effect variable to generate the electronic image, and displaying the electronic image,

wherein when the associated color is determined as a function of color values, the displayed electronic image has a plurality of pixels.

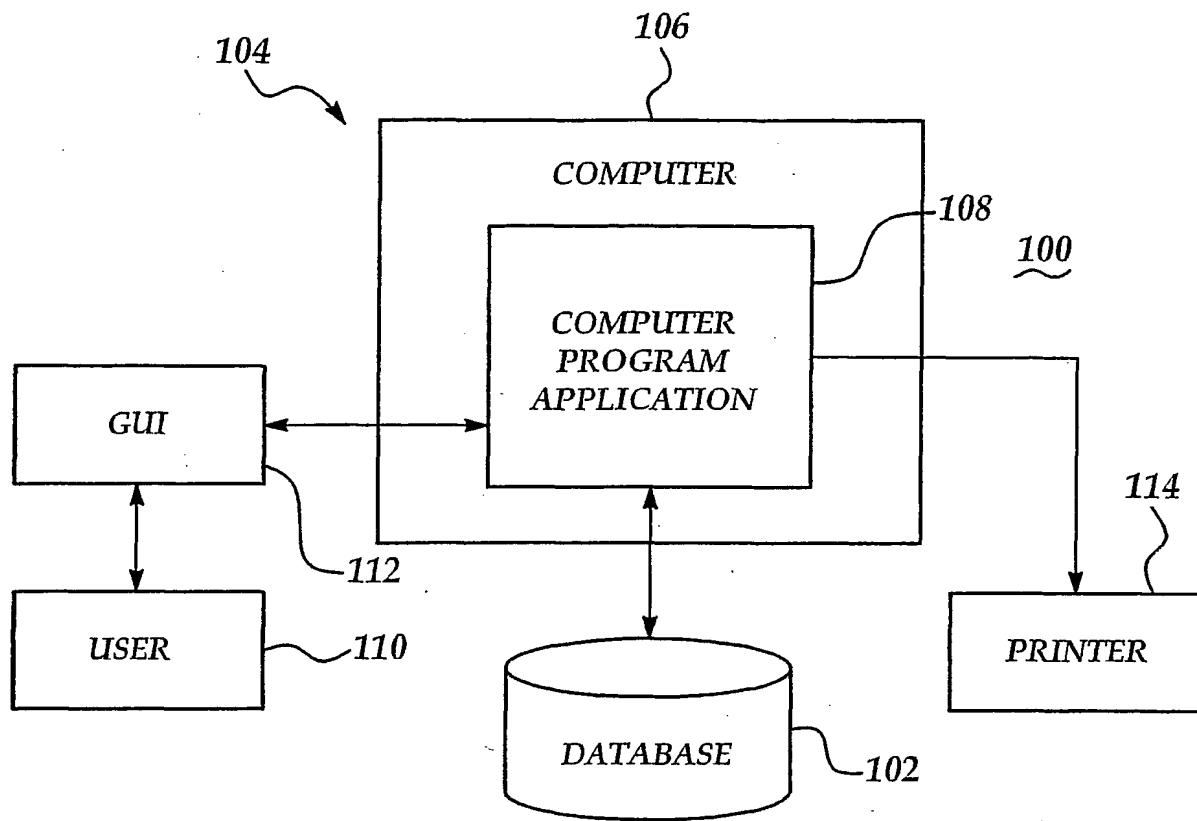


Figure 1

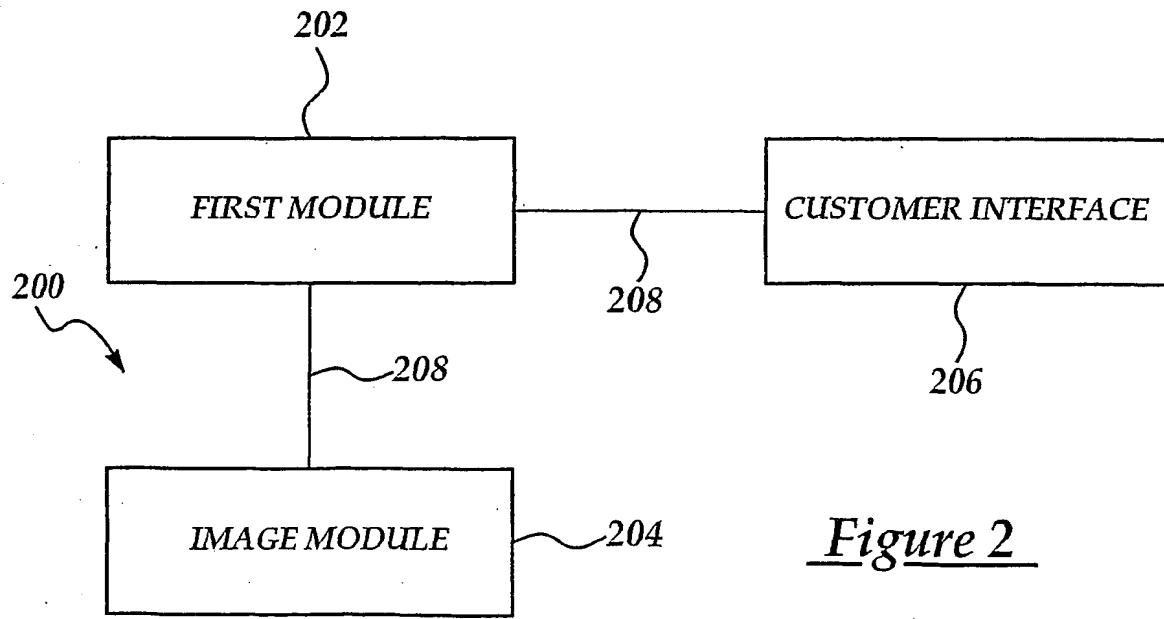


Figure 2

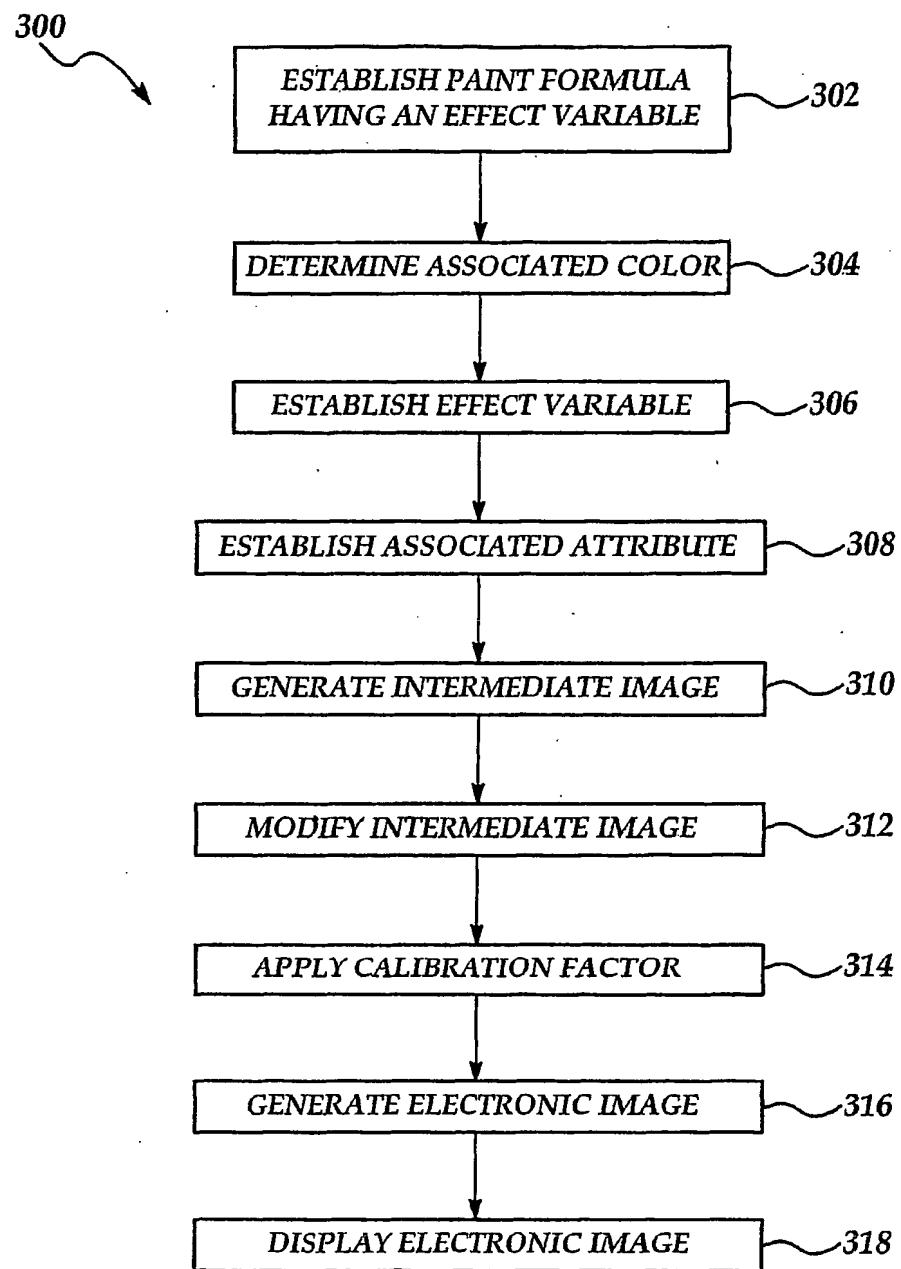


Figure 3

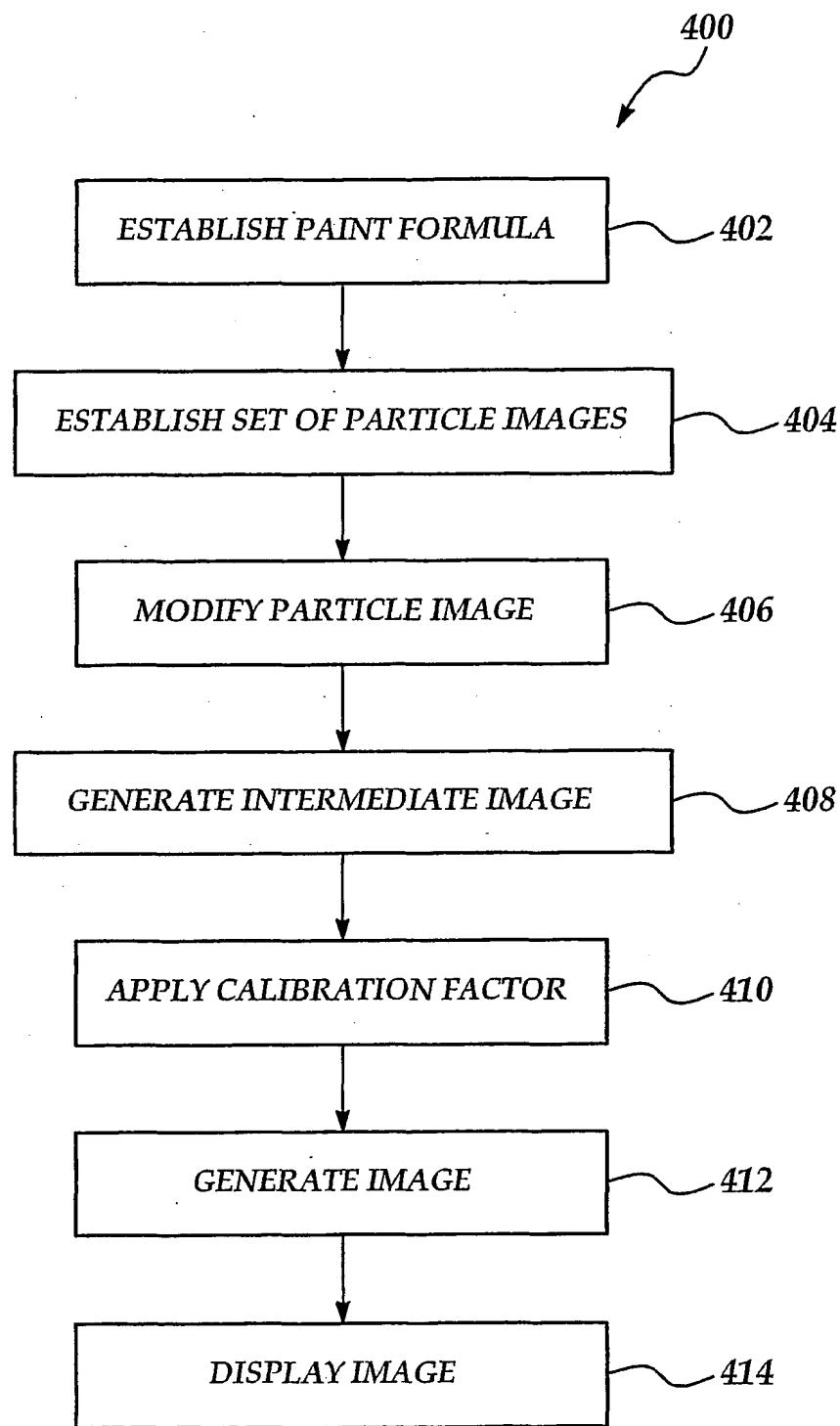


Figure 4

# INTERNATIONAL SEARCH REPORT

International application No

PCT/US 03/30756

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 G06T11/40 G01J3/46

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 G06T G01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 014 221 A (PLUDE JR HOWARD H) 11 January 2000 (2000-01-11) abstract column 1, line 47 - line 60 column 4, line 10 - line 13 column 4, line 17 - line 20 ----- WO 01 40970 A (GEN ELECTRIC) 7 June 2001 (2001-06-07) abstract page 4, line 1 - line 3 -----	1-37
A		1-37



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Date of the actual completion of the international search

4 February 2004

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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6014221	A 11-01-2000	NONE	
WO 0140970	A 07-06-2001	US 6507824 B1 AU 1457501 A WO 0140970 A2	14-01-2003 12-06-2001 07-06-2001

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